Puerto Rico Hurricane Disaster Relief Efforts

Mike Logan

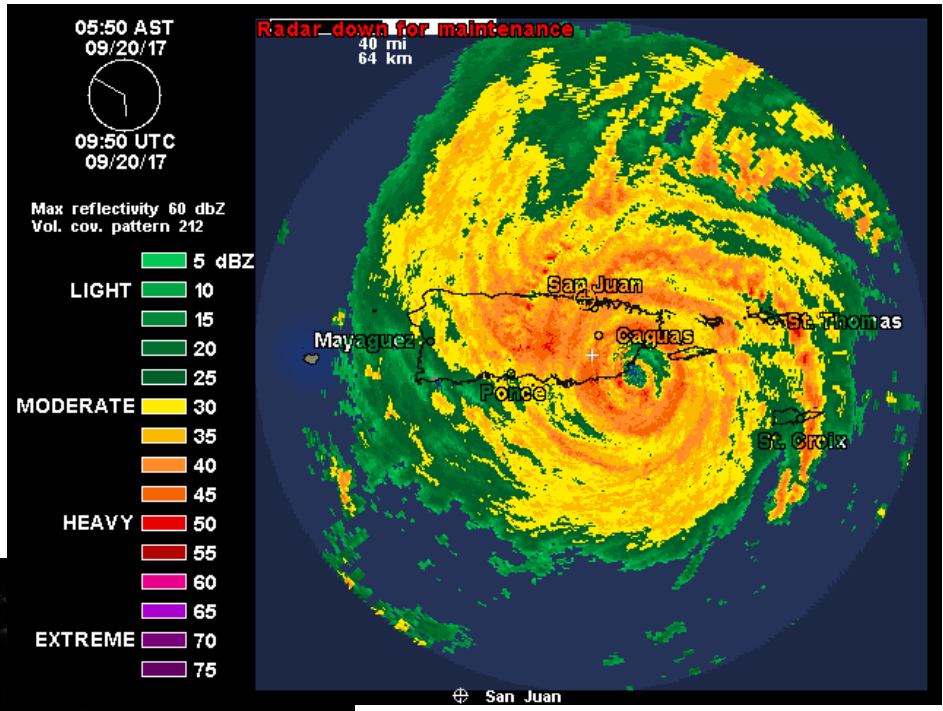
KM4WUO (ham) / NCS916 (SHARES)

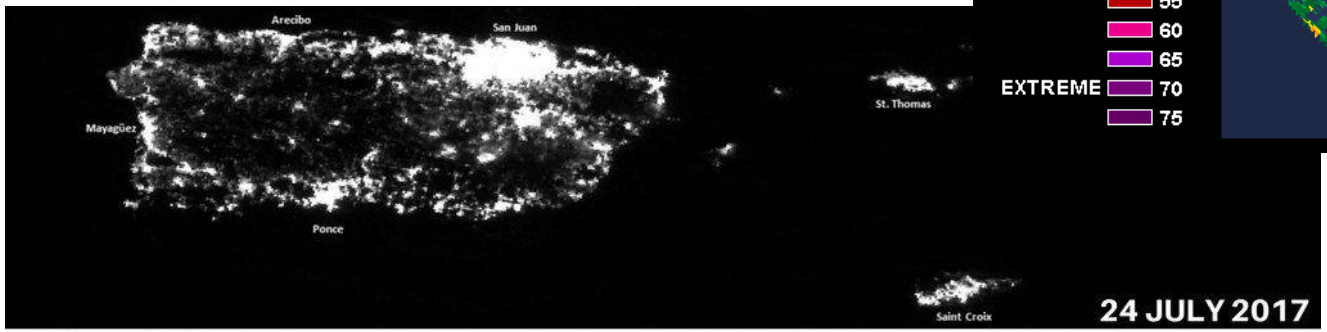
February 2018

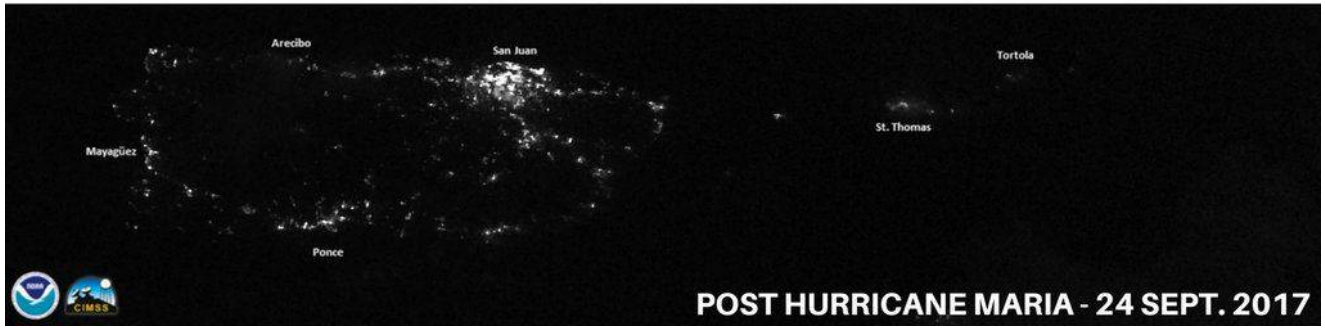
Timeline

- **August 25 - Hurricane Harvey makes landfall near Rockport, Texas**
  September 6 - Hurricane Irma makes near-miss in Puerto Rico
  September 10 - Hurricane Irma makes landfall in the Florida Keys
  September 14 - Volunteered for Surge Capacity Force (SCF) request by FEMA to the entire Federal Government
  September 20 - Hurricane Maria makes landfall in Puerto Rico
  October 6 - Received deployment e-mail (Wave 13)
  October 9 - left home to go to Anniston, AL as part of the SCF
  October 13 - arrived in San Juan, Puerto Rico
  October 20 - dispatched to Ponce, PR
  November 19 - Left San Juan, PR to go home

Hurricane Maria



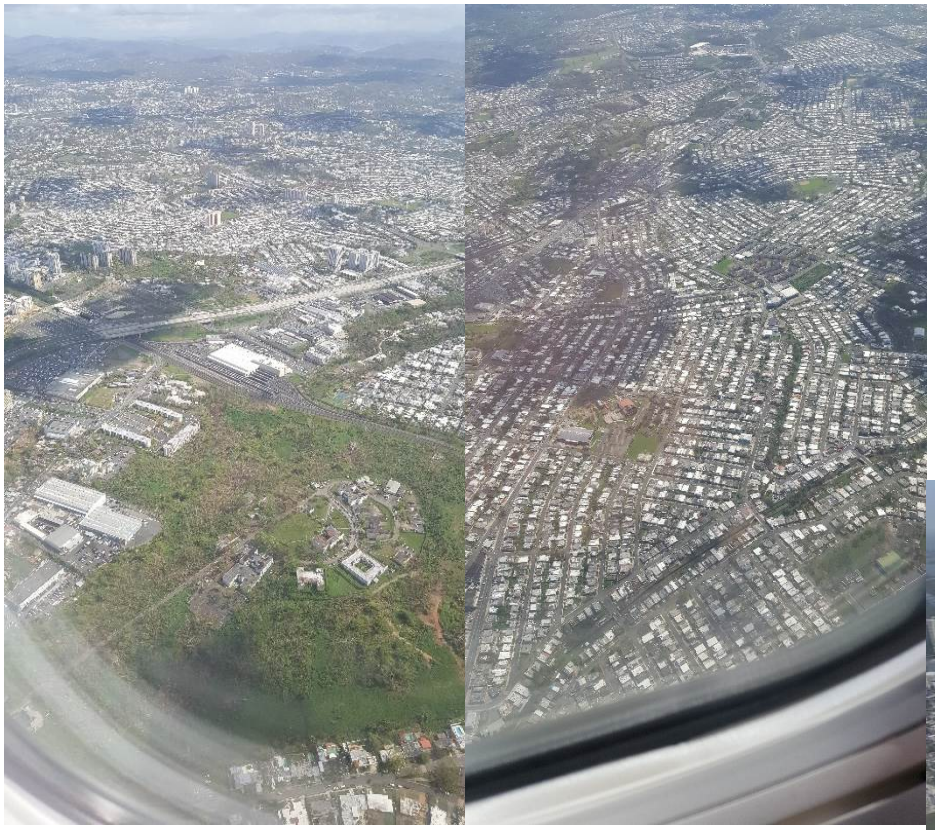




Initial Damage Indications

- **Once Hurricane Maria had exited the area the following conditions were observed:**
  - Virtually 100% of grid power was offline
  - Some 80% of power lines had either been damaged or destroyed
  - There was no municipal running water (no power, possible contamination)
  - There were no sewer systems operational (no power, some damaged)
  - All land lines had failed entirely (lines severed, switching stations damaged/destroyed)
  - Virtually all fiber optic cables had been severed (most were on the same poles as power and cable TV)
  - Sub-marine telecommunications cables to the mainland had been damaged and were not operational
  - No television or radio stations were operational
  - Some 90% of cell and other towers had damage or were destroyed
  - All public safety repeaters were non-operational
  - 911 Center was offline

Puerto Rico from the air

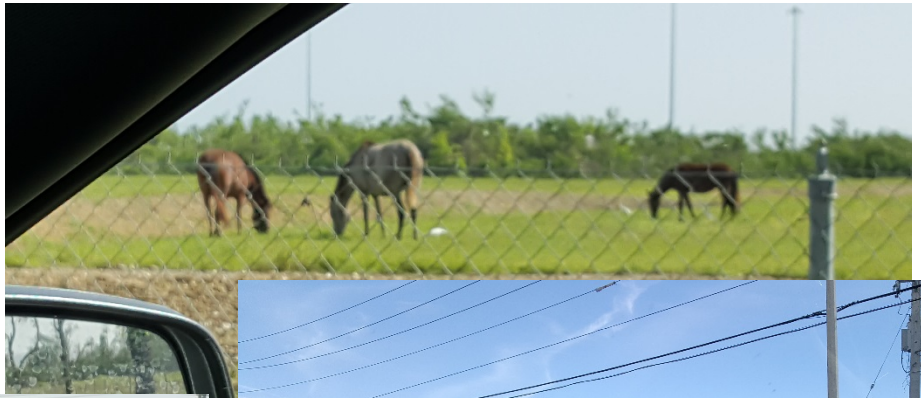


←3 Weeks after Maria

5 Weeks after Maria →

Puerto Rico on the Ground

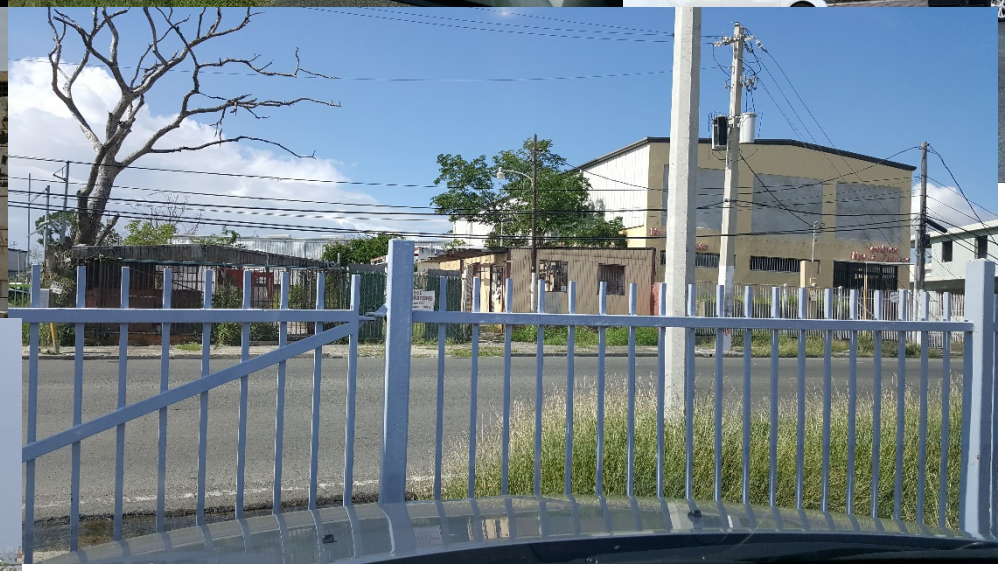
Oddities



Puerto Rico Damage








Power Problems

Communications Problems

SHARES

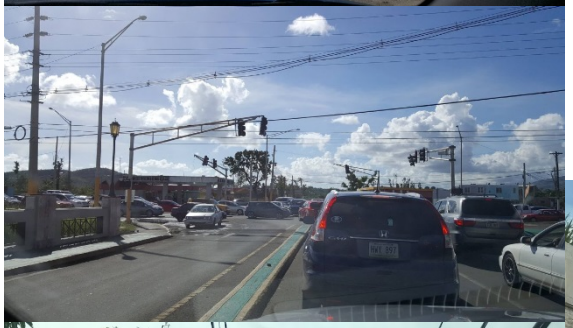
- **The SHAred RESources (SHARES) High Frequency (HF) Radio program, administered by the Department of Homeland Security's (DHS) National Coordinating Center for Communications (NCC), provides an additional means for users with a national security and emergency preparedness mission to communicate when landline and cellular communications are unavailable. SHARES members use existing HF radio resources to coordinate and transmit messages needed to perform critical functions, including those areas related to leadership, safety, maintenance of law and order, finance, and public health.**

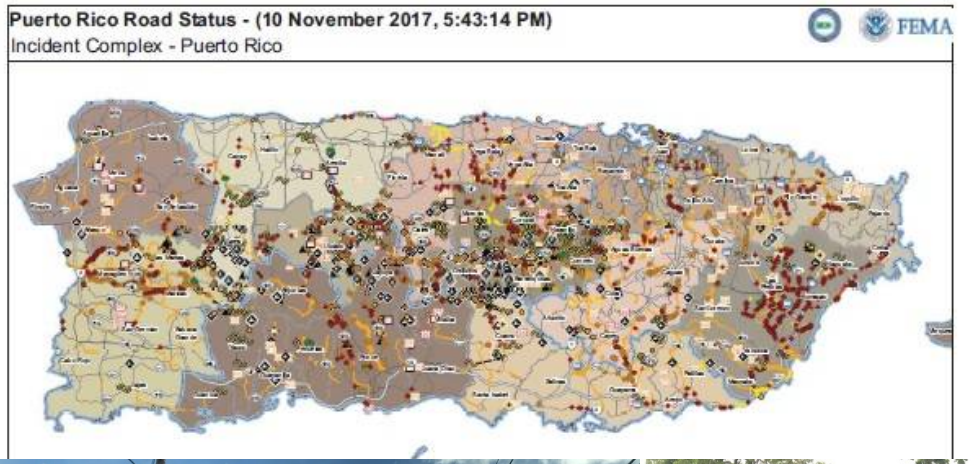
(703) 235-5329

www.dhs.gov/shares

nccshares@dhs.gov

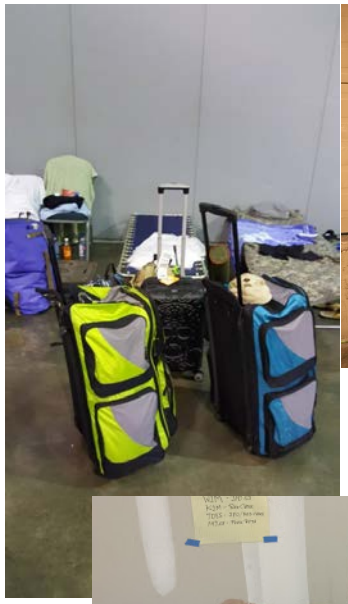
Access Limited



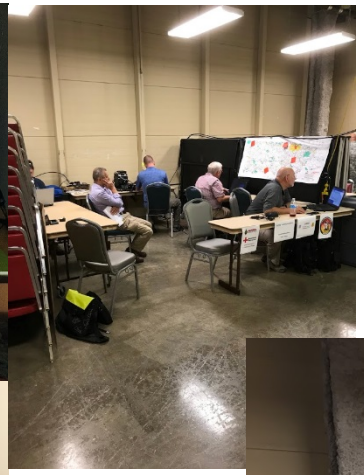


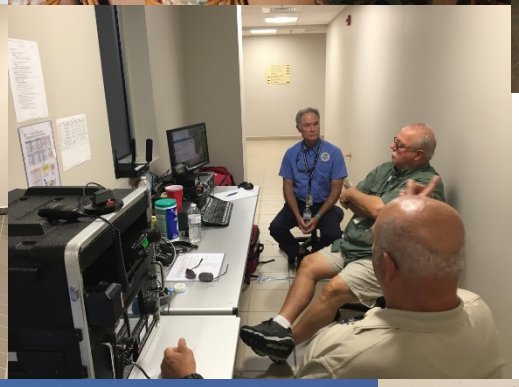
Initial Packing List (Radio)

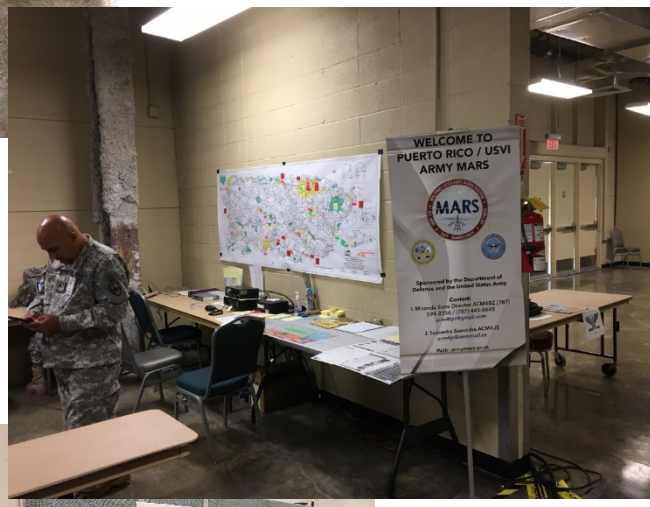
- Yaesu FT-991
- MFJ-939Y tuner
- Samlex 1235M 13.8V 35Amp Power Supply
- 2x 3ft. pigtail of LMR-400 to go between radio and tuner and between end-fed and RF Isolator
- 25ft. LMR-400 coax
- Chameleon EMCOMM-II end-fed antenna
- 4x35ft ground wires for EMCOMM-II
- MFJ-1913 28ft. Telescoping mast (46" collapsed)
- Comet UHV-6 mobile antenna with 40m and 20m coils
- MFJ-335BS 5" mag mount w/18ft. of coax attached
- MFJ-1699S HF portable antenna (just for grins)
- MFJ-915 RF Isolator
- RigExpert AA-1400 Antenna Analyzer
- Carabiners (roughly 6 suitable for climbing/rappelling/holding up antenna guy lines)
- 1x 100ft. 550 paracord
- 2x 50ft. 1100 paracord
- Bioenno PowerPack 400 (35Ah LiFePO4 battery, 300W pure sine wave inverter, 12V DC output, built-in solar charge controller, 70W wall wart AC charger)
- 2x CigBuddy 12V cigarette lighter to PowerPole adapters
- 2x 10ft. PowerPole Extension cables
- 1 USBuddy 12v to USB charging adapter
- 1 Powerpole to 12V cigarette adapter socket
- ACO Power 105W solar panel (which included a 12V car battery charger and a PowerPole cable to plug directly into the Bioenno)
- 1 roll 2" Gorilla tape
- 1 roll 1" Gorilla tape
- 1 roll 2" Velcro one-wrap strap
- 1 roll 1" Velcro one-wrap strap
- 1 roll small Velcro cable wraps
- Small bottle of CA glue
- 1 30W soldering iron (Harbor Freight)
- 1 roll solder
- 1 box assorted heat-shrink tube (Marine heat shrink w/adhesive from Harbor Freight)
- Small set of tools which included pliers, wire stripper, small adjustable wrench, wire cutter, screwdriver with multiple bits
- 8x10' Tarp
- 2x 6-pack Kelty Nobendium tent stakes
- Various pouches to hold gear (padded PS/4 pouch for radio and power supply, neoprene pouch for tuner, mesh pouches for antenna, soldering kit, tool kit)
- small random assortment of SO/PL-239 twist-on coax connectors
- Gateway 17" laptop with power supply and mouse, Win 7, loaded with HRD, fldigi, RMSExpress
- Multi-meter (Harbor Freight give-away)
- Bioenno PowerPack 400 (35Ah/400Wh battery, 300W pure sine inverter, DC output, solar charge controller, wal-wart charger)
- One Surge Supressing Power Strip

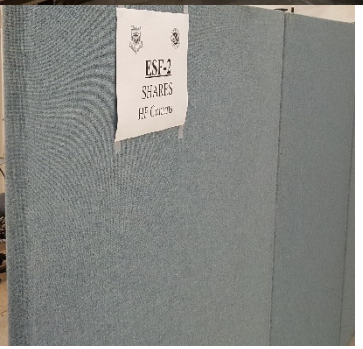


SETUPS









What Worked

- The FT-991 was a great rig to have there. It had enough options to filter out a lot of noise but not enough to overcome the highest levels. Need to have the MARS mod done. I looked at what was involved and opted NOT to try that in the field.
- The end-fed antenna did OK. Had it been put up as a sloper rather than inverted V, it would have been better for DX. As it was, it was a compromise antenna that did OK for intra-island comms and some comms back to the mainland.
- CS-108G+ did OK, particularly considering it's a "QRP" rig.
- Yaesu VX-8DR did fine. While I was there, I did the MARS mod on it. Trivial.
- The Bioenno PowerPack 400 was great. It got used for its battery, inverter, and the solar charger worked great. With the battery half-dead, the solar charger was putting roughly 80W back into the unit in full sun. The pure sine wave inverter isolated the power for the radios from the grid power.
- The inflatable sleeping pad was great. Not very heavy, a little bit bulky, but great.
- LMR-400 was good but too short.
- RG8x was much lighter and fit thru the hatch in the roof.
- RigExpert was incredibly useful. I tuned the lengths of my mobile antenna as well as helped the PRNG get the length of their antenna right.
- Flashlight was a great thing to have and I wore mine on my belt. Somehow I managed to lose it.
- Having all the radio software already loaded, configured, and known to work with the rig I had was monumentally better than trying to do it in-situ.
- Had to use CHIRP and the RTSystems SW to program frequencies, particularly on the handi-talkie. Glad I had all that.
- Comet UHV-6 was a great mobile HF antenna, particularly after I tuned the whip stubs to the length I needed.
- MFJ mast did a great job, wasn't too heavy to carry, and fit inside the same fishing rod tube with the Comet mobile.
- Pre-loading Google Maps maps of the area we were going to be in could have been a lifesaver. As it was, with cell service so spotty, we would not have been able to navigate without downloading the maps first.
- My team mate had a Pactor modem. It worked much better than the SW modem in Winlink.
- I had a sufficient number of CigBuddy's and PowerPole extension cables that I could set up for either station operation or mobile operation with very few changes.
- The Solar Panel worked well. If it had been cloudy, though, it would not have kept pace with the power drain. (The laptop and the FT-991 when transmitting together was using right at 300W.

What Didn’t Work

- Having a large number of RF radiators in close proximity was bad for all of them. For us, it made certain comms impossible. For the Army and the first satcom dish they put up, they had to turn up the power level so much they burned out the unit within a couple of weeks. With an RF noise floor of S9+20dB, you're going to have a really, really hard time with reception. Have a "roof Nazi" that keeps you and the other radiators from causing RF fratricide.
  - The FEMA processing at Anniston was “sub optimum”.
  - The ESF-2 function had the wrong priority focus and they didn't understand the utility of HF. After I spoke with the FEMA OCIO and CTO who visited our station in Ponce un-announced, I suspect that will change.
  - The FEMA supplied laptop was so locked down, I couldn't install any of the software I needed to use.
  - Winlink using the Winmor module had issues unless conditions were very good. Sometimes, the client-server synchronization would get hosed and the SW dropped the connection.
  - When we went to take down the mast, the Gorilla tape tore off some of the lacquer paint on the mast. I'll have to find something to paint the fiberglass with now.
  - Carrying that much gear in an inconvenient form factor was a royal pain. Living within the checked baggage limits really creates issues. Next time, I may check into the freight departments at the airlines who are better about such things. Several folks down there used Southwest's air freight to get stuff shipped to them and back.
  - Team mate's rig did not have an RF-isolator on his lines. So, he was getting a lot of RF back into the station. So much so that it would induce enough noise on the USB line to my rig, the laptop would freeze up if he was transmitting. After I put ferrites on both ends of my USB cable, that problem went away. Sadly, my touchpad on my laptop got fried with his RF and did not recover.
  - Since I had quite a bit of stuff sent to me there, either stuff I ordered or stuff the wife sent, I had way, way too much to fit in the baggage I had. So, I had to ship a bunch of stuff back via Post Office. It cost almost $180, and Fedex would have been double that.
  - The rolling duffels I used did not stand up to airline gorillas well. One died on the way down, the one that survived is toast now that it came back.
  - The PS/4 padded case snugged inside the hard case didn't prevent one of the knobs from getting broken off on my 991. Airline gorilla disease strikes again. I put bubble wrap around it before I stuffed it into the padded case on the return trip.
  - The wire for the end-fed became hopelessly tangled on take-down. I'll have to make a new wire, using better wire that's less likely to tangle. If we'd had to set up someplace else, my antenna would not have been usable.
  - The small soldering iron I’d brought didn’t work well. It was chrome plated pot metal not stainless. Had to buy another soldering iron and it worked OK but wasn’t hot enough to solder coax.

What Did I Need that I Didn’t Have

- Barrel connectors. If you need to add two coax cables together to get the length you need, you need these barrel connectors. Our other team mates loaned us one but I ended up ordering a batch from DXE.
- UHF-to-whatever adapters. We got handed a VHF antenna with an N-connector. I had to use the adapter that came with the RigExpert to even try to use it. The PRNG PRC-150 has a BNC connector. Nobody had an adapter for that with them. I have a few at the house but didn't think I needed to bring them. Bad choice.
- More coax, lighter coax. DXE's LMR-400 is great coax but it's heavy and I only had 25ft. of it. That would have been fine if we were set up in a tent and the antenna mast was right there. As it was, we didn't have enough coax to run two antennas up to the roof.
- PowerPoles. I didn't bring any. My team mate did, fortunately.
- Big soldering gun. While at the PRNG, we tried valiantly to fix one of their coax's that had the connector not done well. We couldn't generate enough heat to melt the solder into the shield braid. Had that been a critical item, we'd have been screwed.
- More cash. Very few places were taking plastic when I got there. Very few places were taking plastic when I left. Cash is king in a disaster zone.
- I didn't take a spare laptop because I thought the extra weight wasn't worth having a backup. Although my primary laptop didn't fail, other than the touchpad, it would have been game over if it had.
- UPS/Surge Suppressor. Two of our team mates had power supplies fried due to power spikes from the damaged grid power. I had a surge suppressor power strip but I'm not sure how good it would have been under the extreme conditions.
- Power strips and extension cords. Luckily, the FEMA folks had some of those, but they all got used up. Even at the hotel, they used wall sockets for all the room lighting, leaving few outlets for actual use.
- More clothes. Only because there wasn't a way to wash clothes other than by hand. Warm weather clothing is generally fairly light so it probably would have made sense to bring more. It wasn't a big deal to wash a set since I'd brought the ability to do so with me.
- The ability to make an antenna. I really should brought with me the ability to make a big horizontal loop antenna. This likely would have either cured our insufferable RF noise problem or would have at least toned it down to make reception viable.
- A method of satellite communication would have helped during those periods where other comm methods were down..
- Goof Off. The Gorilla tape left a nasty residue on the mast. I had to go buy some Goof Off to get rid of it before I could collapse the mast.
- Ferrites. Lots of ferrites. Ferrites for both ends of every coax, ferrites on all the USB cables, ferrites on the CAT/Tuner cables, RF isolators at the antenna feedpoints.
- Lightning arrestors. Several times, storms would pop up that had lightning and we left the antennas up all the time. Had it hit the giant metal roof or our nice conducting wire antennas, it could have seriously damaged our radios. One of our team mates had a near miss and it fried a barrel connector and one end of the coax cable.

Some Things to Remember

~~- I need to have all my radios be MARS/SHARES capable.~~
- The National Guard, who is always called up during a disaster, may or may not have the ability to communicate using HF when they need to. Don't count on them to be informed or coordinated because of that, particularly soon after the disaster.
- Verify all your gear works and plays nice together before you leave and after you get where you are going.
- Have a backup plan. The team adopted the motto "Semper Gumby" because we needed to be so flexible to adapt to so many changing conditions.
- Don't make too many assumptions about where you'll end up setting up your station.
- Information is very hard to come by during and after a disaster. One of the missions that ESF-2 was forced to take on was getting enough TV and particularly radio stations back on the air so that people could find out where to go for aid and general news about what's going on. Otherwise, there would have been all these food and water distribution centers set up, but no way to tell the people that they're there.
- We need more hams in more communities. We need them to be able to get on the air as soon as the wind slows down. We need some of them to go to hospitals, fire stations, police stations, etc. to be able to communicate. We need hams to be able to tell their neighbors what's going on and help them to send word to relatives of their neighbors that they are OK. We need hams to know their area and neighborhoods well enough to be able to relay important messages to specific folks in their area. We need hams to be able to report conditions in their specific area to the people coordinating the response and recovery efforts. And, we need hams to relay important information from the officials that they would not otherwise be able to broadcast to the people who need the information. We need hams that can get on the air and stay on the air for potentially a few weeks. Maybe not 24/7 obviously, but they need their own power source to be able to help the community during a major disaster.
- I need to have a Pactor 4 modem. They are stupid expensive but the guys that had them were able to pass messages when conditions wouldn't let me. All the SHARES message servers are Pactor, they don't allow Winmor.
- I should probably get an amp. There were a number of times where because of conditions, 100W and a wire just didn't cut it. Powering the amp becomes a major challenge, though, particularly as you go up towards the legal limit.

Other EMCOMM Observations

From my perspective, it would be entirely reasonable for the ARC (and other NGOs like Salvation Army, Team Rubicon, etc.) to want to:

- provide Safe and Well transmission capabilities to each of the shelters they are responsible for,
- provide a method for communicating and coordinating the deliveries of needed supplies to and from those shelters,
- provide a method for transmitting their daily status and census to State EMA and FEMA,
- provide a method for transmitting urgent requests to State EMA and FEMA for those things beyond their ability to handle themselves

In addition, PREMA/FEMA should have had the ability to:

- provide communications for hospitals to be able to communicate with each other and State and FEMA
- provide communications for local public safety agencies like EMS, fire, and police as well as municipal agencies such as the power, water, and sewer departments (remember, there was no running water on the island right after the hurricane)
- provide communications for assessment teams to relay information in real-time back to the command center
- provide backup communications for State EMA and/or FEMA satellite offices for those times when critical communications needs occur during failures of other modes (which happened frequently while I was there)
- provide a means to communicate and coordinate with the National Guard and DoD units that were deployed in real time (Although many of the PRNG and Army units did not have HF ability but that's a problem unto itself)

More EMCOMM Observations

- **Operators should have had a "Go Kit" that includes:**
  - Fixed Station HF Radio plus tuner and sound card interface (if required)
  - Pactor modem
  - Mobile HF Radio plus tuner
  - Handheld VHF/UHF
  - Mobile VHF/UHF
  - Battery Power, Solar charger
  - Antennas (fixed and mobile) and masts
  - Coax cables
  - Parts, Tools (including antenna analyzer), and Supplies
- **Operators should have had a "Stay Alive Kit" that includes:**
  - Foodstuffs for 3 days to a week
  - Water and/or a way to purify same
  - Portable shelter or tent, cot and/or sleeping bag/pad
  - Toiletries, medications, clothes

More EMCOMM Observations

- **Your "Backup" communications may not be available:**
  - In PR, land lines were inoperative along with the cell network and broadband internet
  - VHF/UHF repeaters were not functional
- **Your "Backup" communications may be everybody else's:**
  - In PR, Satcom usage went from 60 minutes/day from 10 users to 16,000 minutes a day from more than half of the 3,000 satcom users.
- **More ways to communicate are better than fewer:**
  - Military has a mission planning acronym: P.A.C.E
    - Primary
    - Alternate
    - Contingency
    - Emergency
  - Have multiple ways of communicating which don't require grid power, or other "modern" communications in the disaster zone which might not be available.

Helping the National Guard

Lesson Learned #1

- **Disasters are always "come as you are" parties.**
  - If you don't have something when disaster strikes, you aren't likely to be able to get it if/<u>when</u> you need it.

Lesson Learned #2

- **You really don't appreciate how good you have it until you come face-to-face with people that don't have it so good.**

The Future for Puerto Rico?

#PuertoRicoSeLevanta

"Puerto Rico is Rising"